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Assessment of Decay and Storage Area for Activated Materials in the National Ignition Facility

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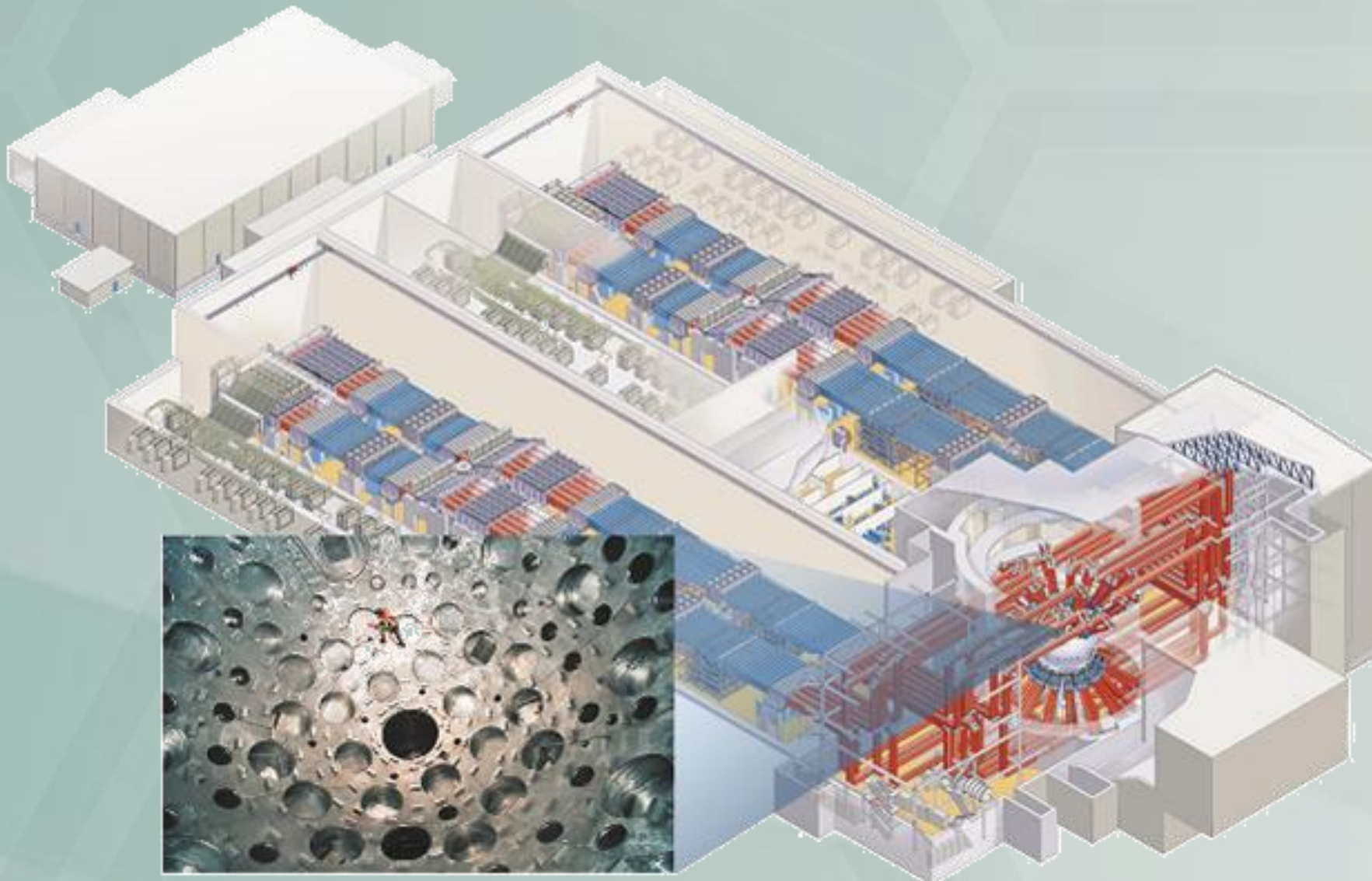
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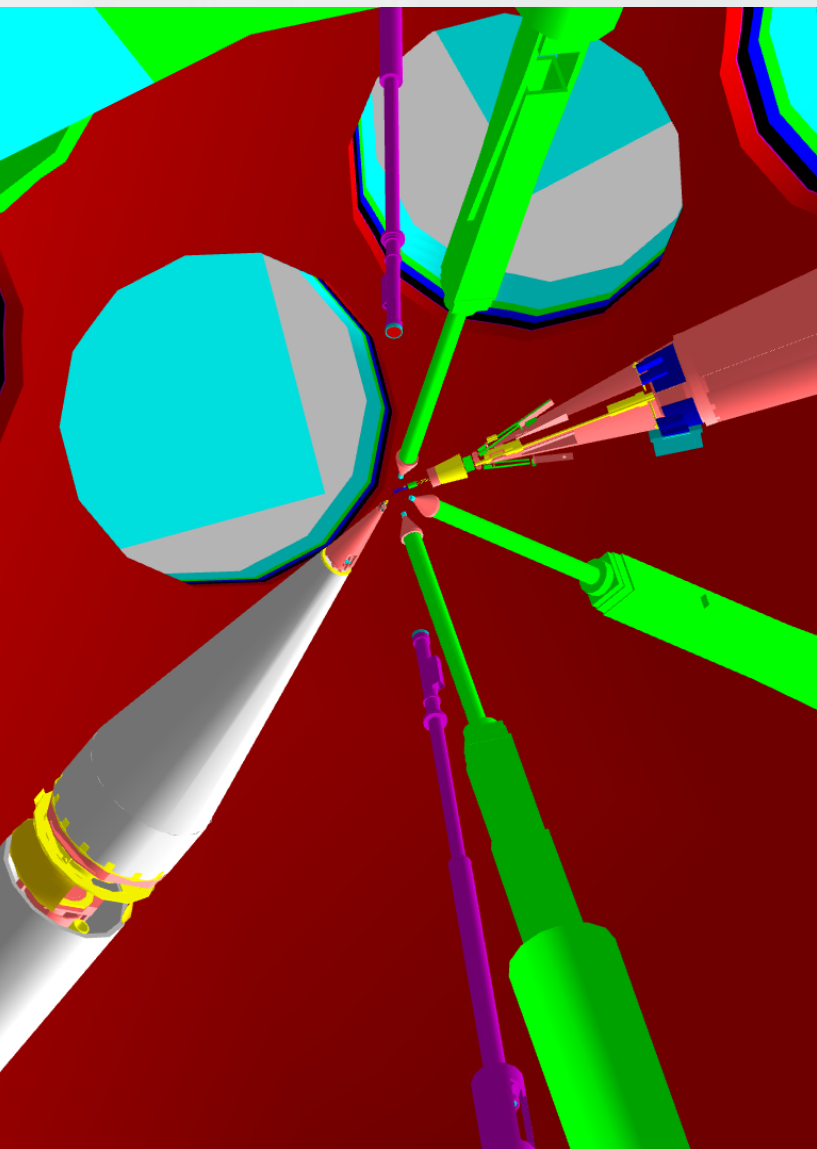
THE NATIONAL IGNITION FACILITY



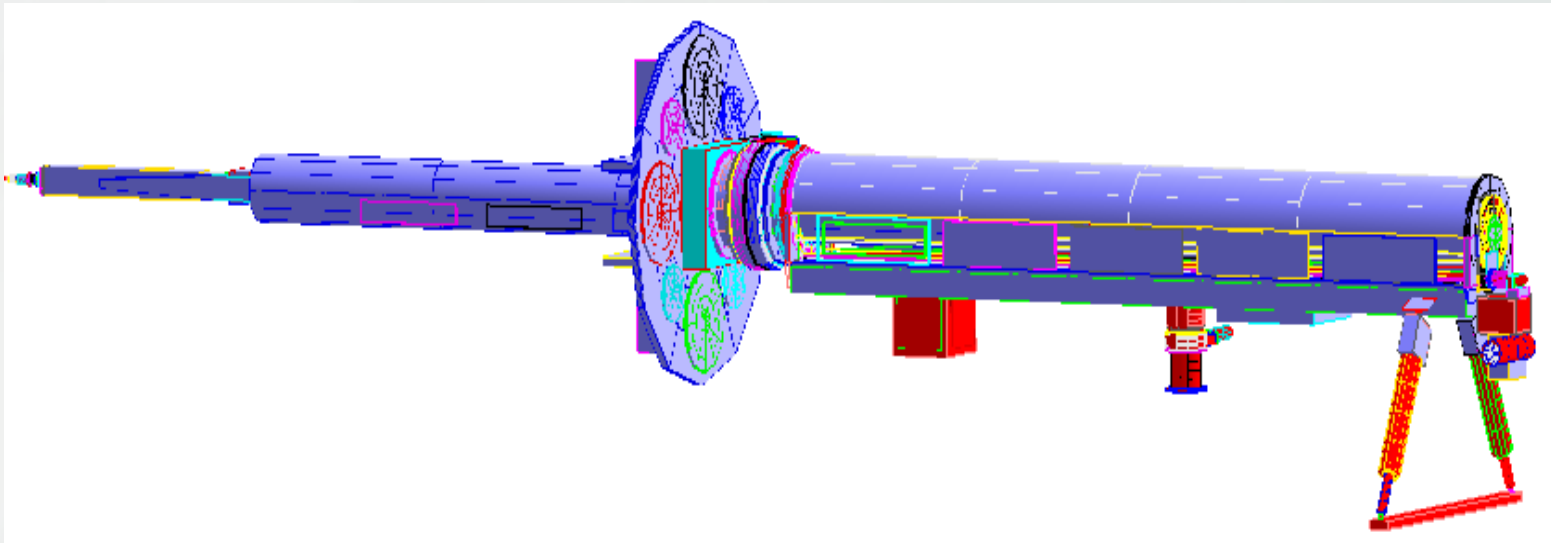
The National Ignition Facility (NIF) is the world's largest and most energetic laser system for inertial confinement fusion. The NIF is a 192 laser beam facility that is capable of producing up to 1.8 MJ, 500 TW of ultraviolet light. During the ignition campaign, the NIF is expected to generate shots with varying fusion yield (up to a routine yield of a 20 MJ per shot).

Activation of DIM Snouts

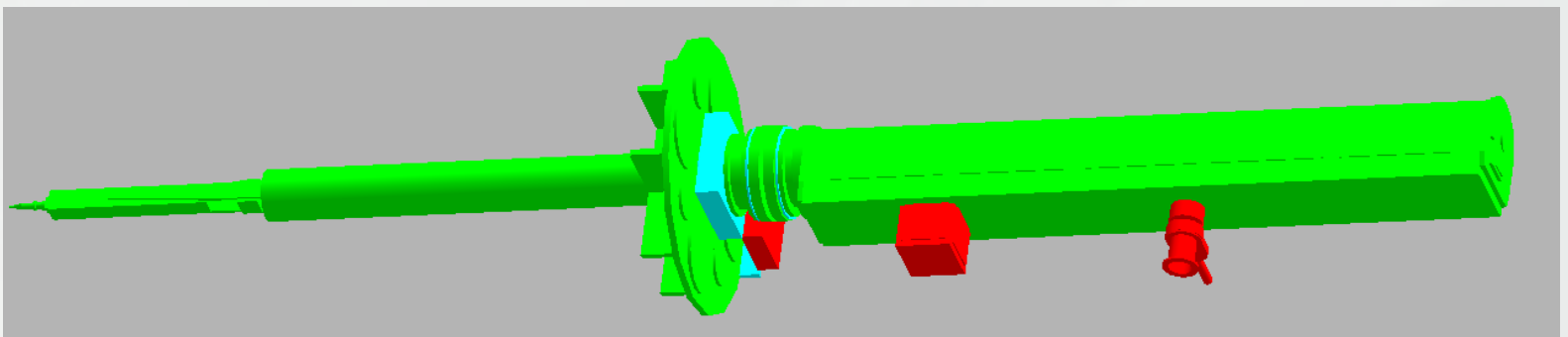
- Low-yield D-T shots ($<10^{16}$ neutrons)
- DIM snouts are within a distance of ~ 10 cm from the target
- The snouts are mostly made of aluminum alloy and require frequent replacement
- Three DIM snouts are removed at 3 hours following a shot
- A total of 24 snouts (8 day inventory) are stored in the decay and storage area



Extended DIM Models

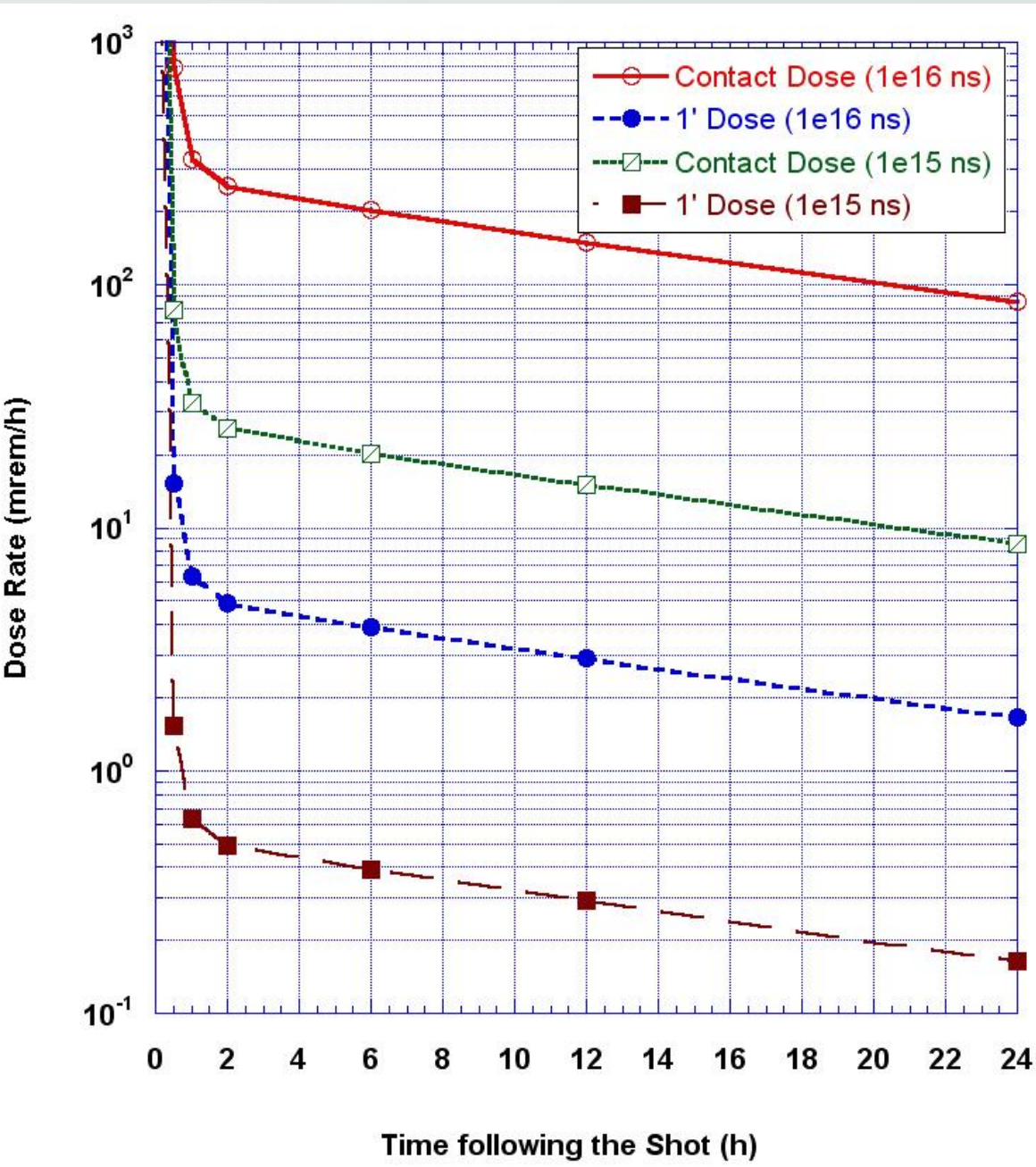


Equatorial DIM

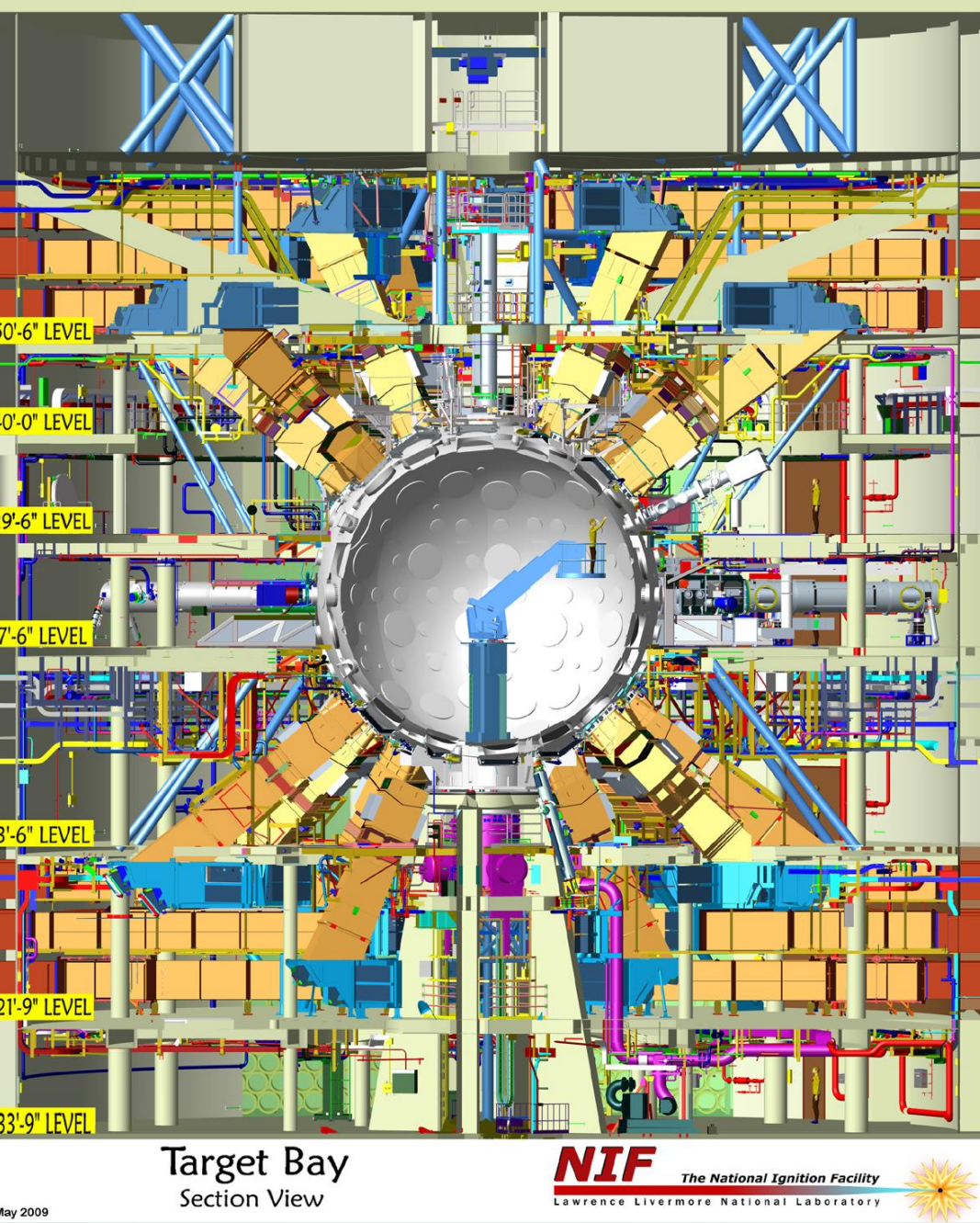


Polar DIM

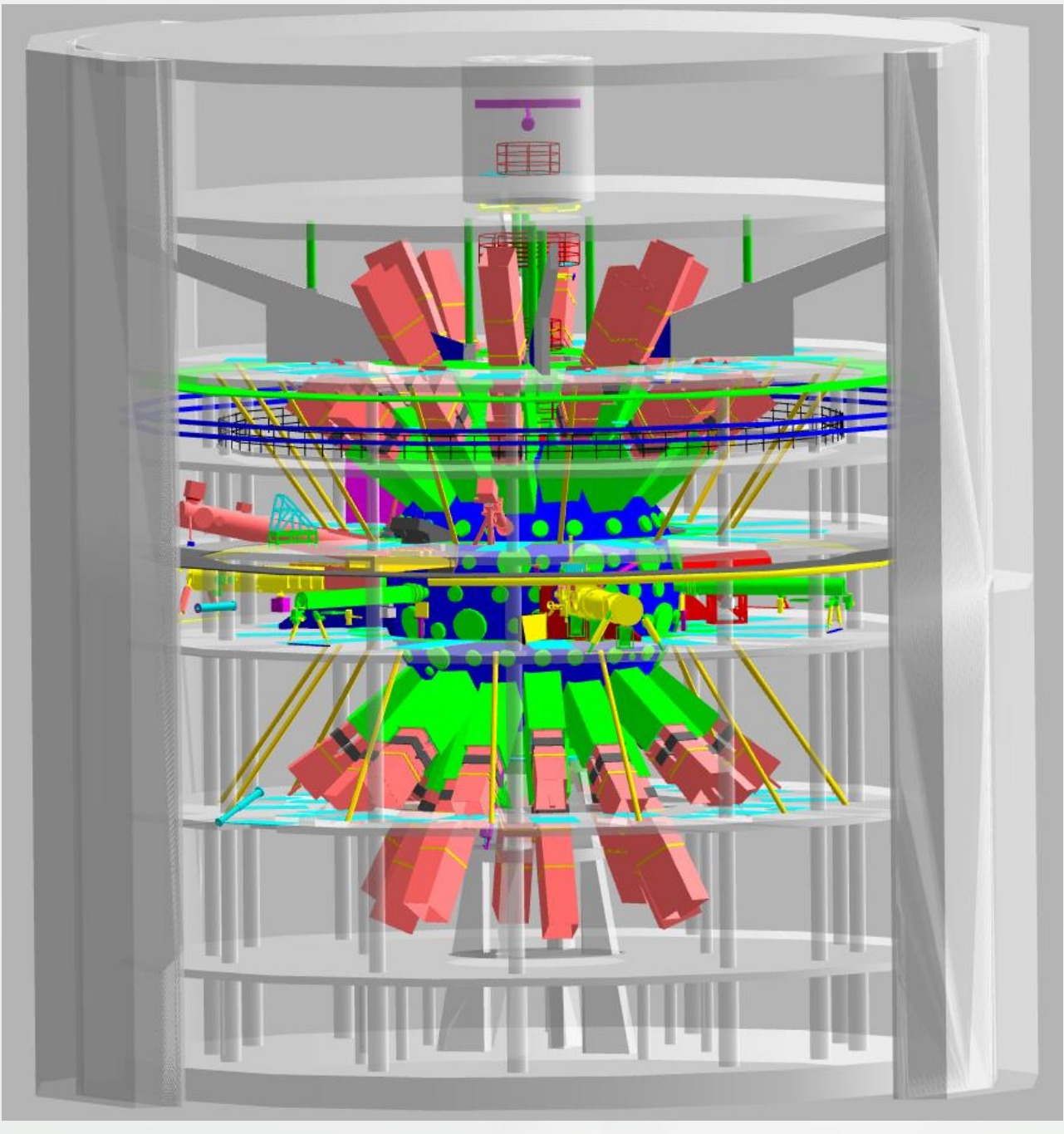
Dose Rates at 1' from Polar DIM Snout



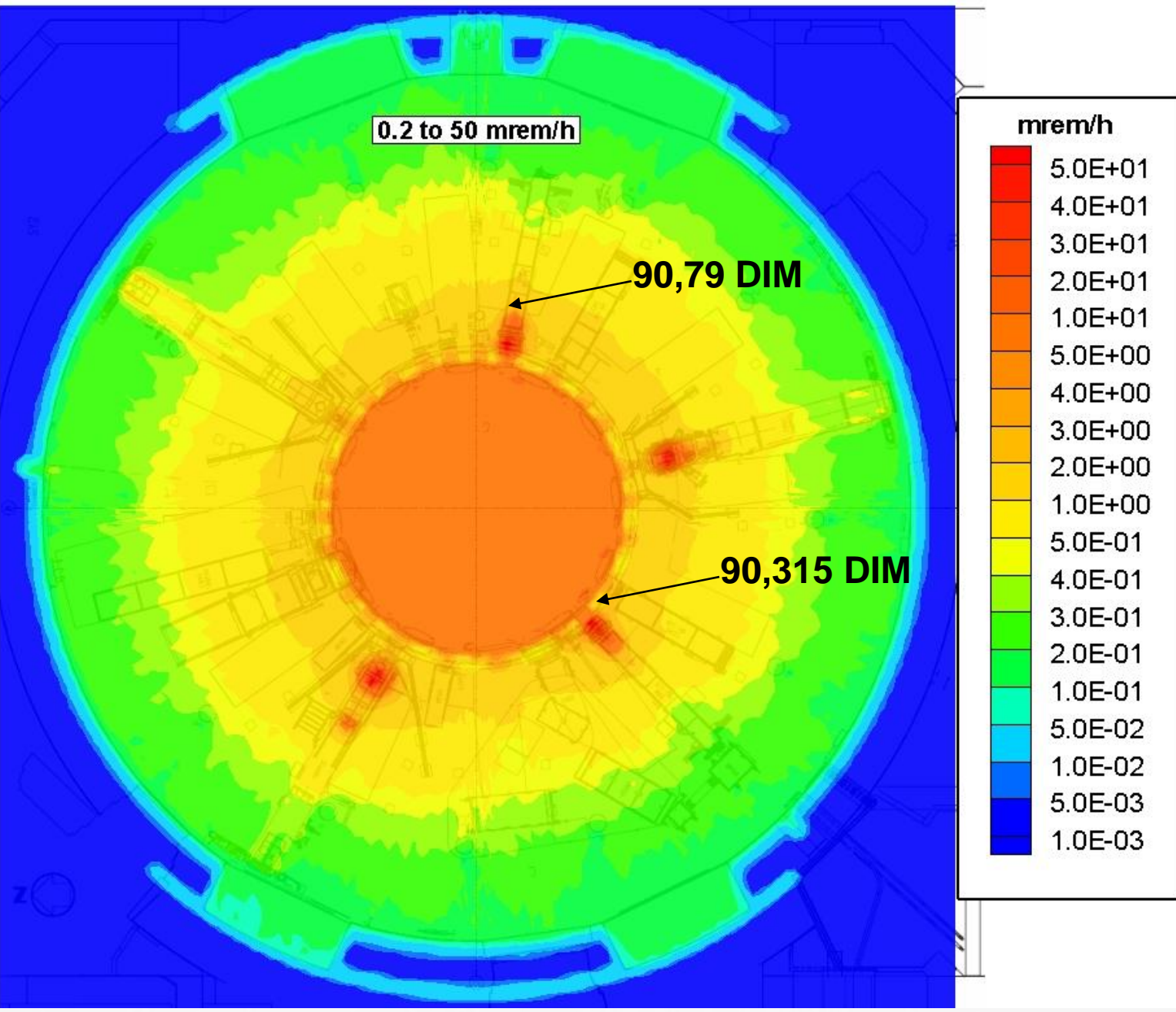
Sectional View of the Target Bay



Target Bay (TB) Model



Dose Rate Map at the Equator (3 hours cooling)



Dose Rates in the Vicinity (~ 1') of the Retracted Equatorial DIMs

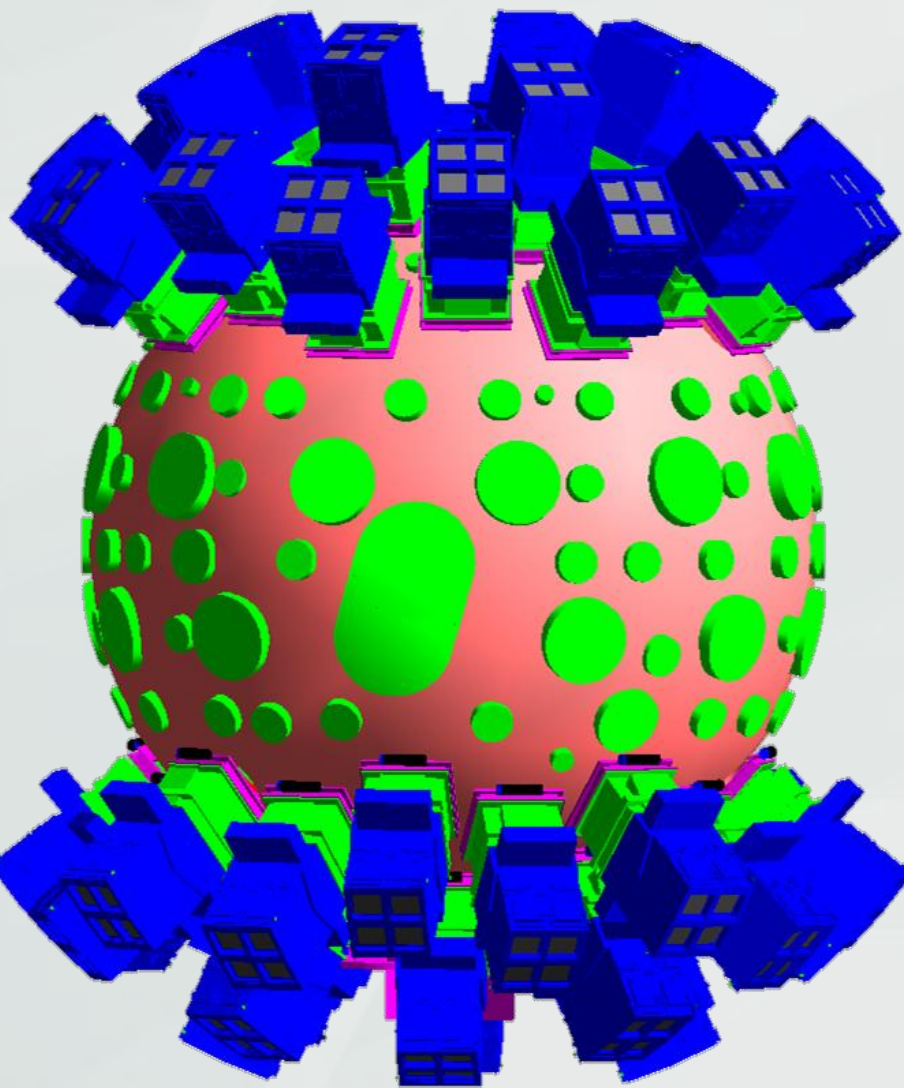
Cooling Time	Dose Rate (mrem/h)	
	DIM (90, 79)	DIM (90, 315)
1 h	3.1	2.9
3 h	2.3	2.1
6 h	1.8	1.6
12 h	1.3	1.1
1 d	0.7	0.6
3 d	0.1	0.1
6 d	<0.1	<0.1

Dose Rates outside the DIM Snout Decay and Storage Area



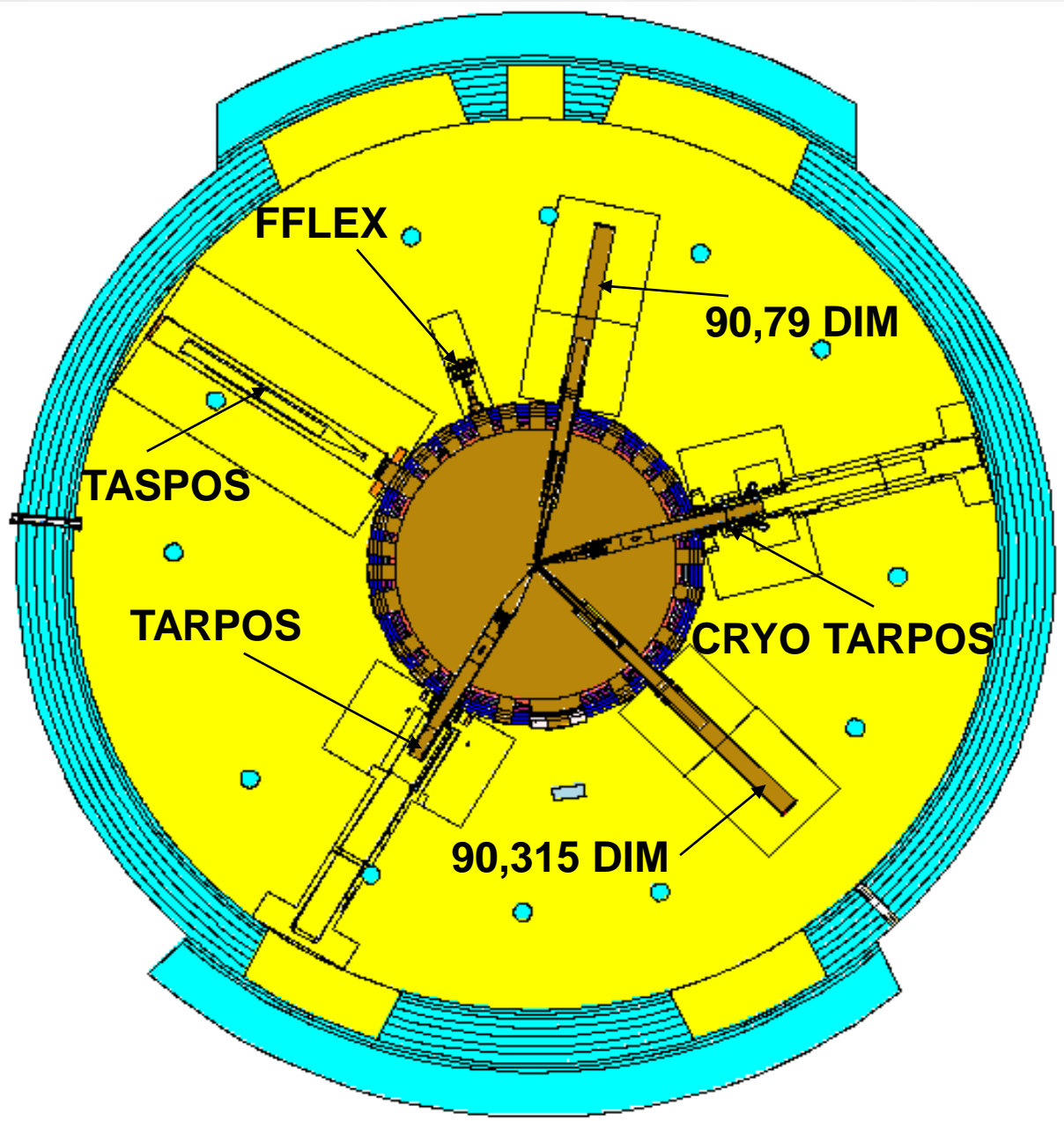
Target Chamber Model

- 192 laser beams
- 1.8 MJ 3 σ light
- 500 TW of power
- 10-m diameter Target Chamber
- SS409 first wall panels
- 10 cm-thick Al-5083 chamber
- 40 cm-thick gunite shield

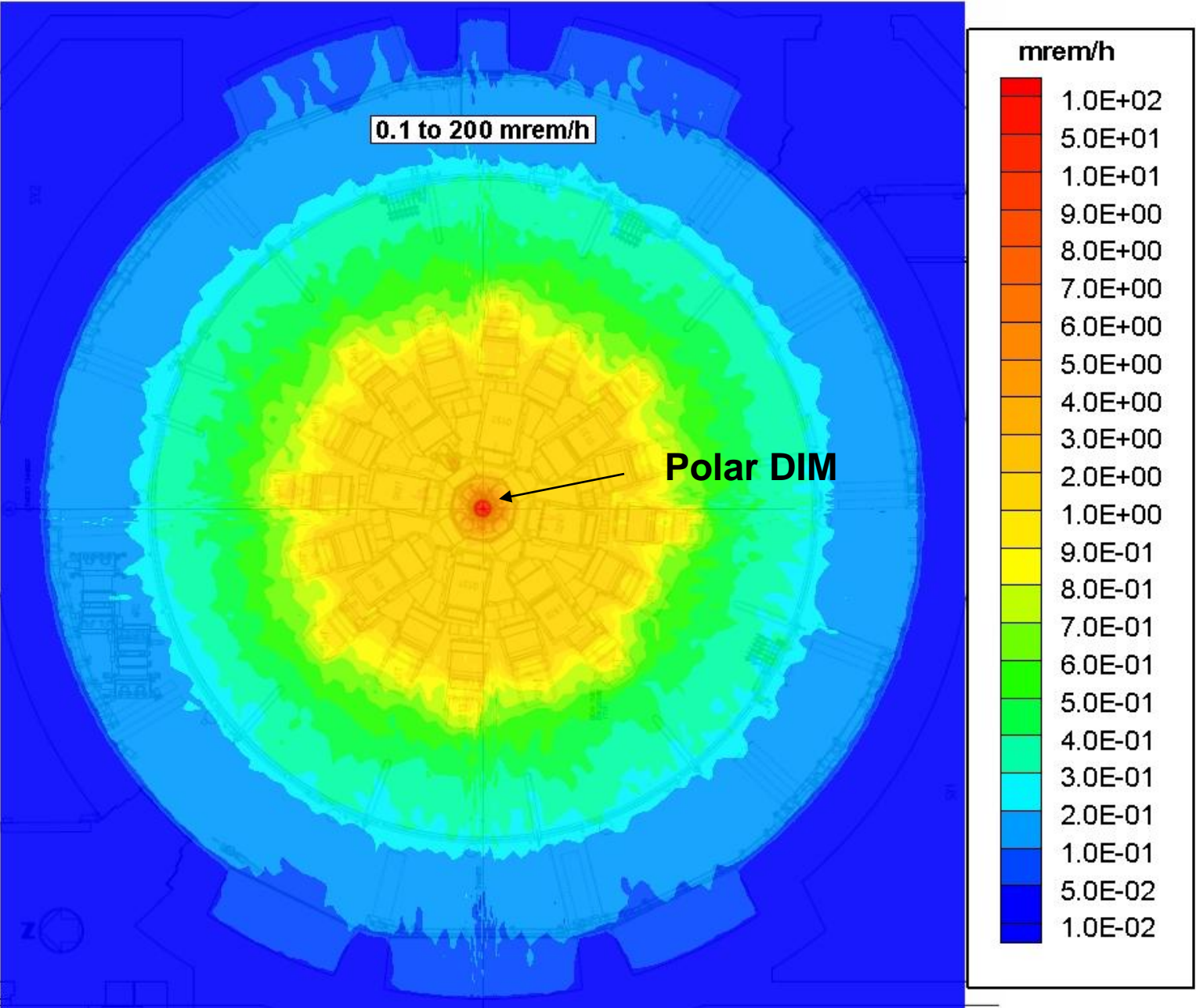


3-D Model of Target Chamber

MCNP Model of TB during a Shot



Dose Rate Map Near Polar DIM Snout (3 hours cooling)



Dose Rates in the Vicinity (~ 1') of the Retracted Polar DIM

Cooling Time	Dose Rate (mrem/h)
1 h	3.8
3 h	2.7
6 h	2.3
12 h	1.7
1 d	0.9
3 d	0.1
6 d	<0.1

Summary

- A storage and decay area has been designated for storing used DIM snouts following low yield D-T shots ($<10^{16}$ neutrons)
- The current storage and decay area is designed to hold a total of 24 snouts (8 day inventory)
- Most of the dose is due to decay of the ^{24}Na ($T_{1/2}=14.95$ h) isotope
- Due to the rapid decay of ^{24}Na , 70% of the dose rate outside the area is due to decay of the newest 3 snouts
- Creating a 10' exclusion boundary around the decay and storage area is sufficient to reduce the dose rate outside the fully utilized storage area to <1 mrem/h after 3 hours following the last shot